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Article (Published Version)

Political Geography 93 (2022) 102544

Contents lists available at ScienceDirect

Political Geography

journal homepage: www.elsevier.com/locate/polgeo

Full Length Article

Towards a multi-scalar and multi-horizon framework of energy injustice: A whole systems analysis of Estonian energy transition

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ARTICLE INFO

Keywords:
Energy justice
Sustainability transitions
Multi-level perspective
Whole systems
Oil shale
Energy futures

ABSTRACT

The shift from carbon-intensive to low-carbon energy systems has profound justice implications as some regions are likely to lose as much as gain from decarbonization processes. Increasing calls have been made to adopt a 'whole systems' perspective on energy justice. Drawing on the Multi-level Perspective on socio-technical transitions this paper presents a new comprehensive framework of energy justice in system innovation, proposing to map injustices along three dimensions: 1) multiple spatial scales (regional, national, international); 2) different time horizons (currently experienced vs. anticipated injustices); 3) connections to transition dynamics (injustices related to the optimization of the currently dominant system, destabilization of the incumbent system or the acceleration of alternative solutions in niches). The framework is applied to analyse the ongoing energy transition in Estonia, involving interactions between the incumbent oil shale based regime and wind, solar, nuclear and bioenergy as emerging niche challengers. The content analysis of news items in Estonian media reveals an inventory of 214 distinct incidents of energy injustices across 21 different categories. We find that many experienced and anticipated injustices are deployed, often strategically, by certain actors to advocate specific energy futures and to influence current political choices. From the justice perspective our analysis thus raises a question whether it is ethical to use probable yet currently unrealized injustices related to regime destabilization and niche acceleration as a means to perpetuate injustices related to the optimization of the currently dominant regime.

1. Introduction

The unfolding climate crisis has exacerbated the need to shift from fossil fuel based to low-carbon energy systems. This shift has profound justice implications that cut across spatial, economic, governance, and distributive dimensions (Murphy & Smith, 2013; Mulvaney, 2013, 2014; Yenneti & Day, 2015, 2016; Yenneti et al., 2016; VonLucke, 2021). Many studies have looked at the way fossil fuels promote violence, authoritarianism and the resource curse, reconfiguring space and social identity in problematic ways (Parenti, 2011; Huber & McCarthy, 2017; Brock & Dunlap, 2018; Daggett, 2018; Jerez et al., 2021; Verweijen & Dunlap, 2021). For example, Sundqvist offers a (2004) meta-survey of the social harms (externalities) of fossil fuels, whereas Healy et al. (2019) investigate the "embodied injustices" of fossil fuel across South America and North America. Even disasters largely exacerbated by climate change itself are prone to their own political ecology with poor and vulnerable often bearing the brunt of the most severe impacts (Sovacool et al., 2018).

The last decade has also witnessed a rapid rise in literature on energy justice (Jenkins et al., 2016; McCauley et al., 2013). Energy justice, which can be seen as a branch of environmental or climate justice (Jenkins, 2018), "is centred around the notion that all individuals should have access to energy that is affordable, safe, sustainable and able to sustain a decent lifestyle, as well as the opportunity to participate in and lead energy decision-making processes with the authority to make change" (Carley & Konisky, 2020, p. 570). Recent fruitful exchanges between the fields of energy justice and sustainability transitions (Jenkins et al., 2018; Köhler et al., 2019) have facilitated a move from the analysis of specific and often local issues to a more encompassing treatment of injustices associated with the energy system as a whole. Hence the emergence of multi-scalar 'whole systems' approaches that attempt to map injustices related to the production, distribution and

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https://doi.org/10.1016/j.polgeo.2021.102544
Received 5 March 2021; Received in revised form 2 November 2021; Accepted 5 November 2021
Available online 13 November 2021

consumption of energy on regional, national and international levels (Sovacool et al., 2019, 2020a). Despite these advances, the existing literature on energy justice remains limited by its descriptiveness, i.e. empirical studies often producing extensive lists of injustices (see Sovacool et al., 2019; Heffron et al., 2021; for some recent examples) without, however, having a clearer theory of the interactions of these injustices over time.

In this paper we seek to address this gap by drawing on an influential theoretical framework explaining how and why transitions occur, the Multi-level Perspective (MLP) on socio-technical transitions (Geels, 2005; Geels et al., 2017). We first use insights from MLP on the role of promises and expectations to open up the conceptualization of energy injustices. We thus propose to expand the scope of the existing 'whole systems' approach by taking into account both currently experienced and anticipated injustices. The resulting multi-scalar and multi-horizon framework is more attentive to the complex dynamics of systems change, creating a heuristic that researchers in energy geography and energy justice can use for comprehensive yet structured injustice mapping. We then use MLP to make the resulting complexity manageable by connecting our identified injustices explicitly to transition dynamics. We argue that this requires a conceptual shift from the traditional tenets of energy justice - recognition, procedure, distribution - to regime optimization, regime destabilization and niche acceleration injustices. This allows us to exemplify issues at stake in different anticipated energy futures and to explore the possibility of patterned injustices over the entire transition process.

We apply our framework to analyse the tensions and injustices of an ongoing energy transition in Estonia, a Eastern European country dependent on a highly carbon-intensive oil shale based energy system. Apart from demonstrating the feasibility of our approach the case also has inherent empirical value for several reasons. First, post-communist countries have generally been understudied in the literatures on transitions, energy geography, and political ecology (see Bouzarovski & Tirado Herrero, 2017; Capellán-Pérez et al., 2020, for exceptions). This matches calls for more attuned "spatial justice" work that can take into consideration how "energy justice is spatialized via landscapes of material and socio-economic inequality" (Bouzarovski & Simcock, 2017, p. 640; see also Brock et al.,. 2021). Second, Estonia offers a compelling case of a regime strongly dependent on fossil fuels for domestic energy supply - 72% of Estonia's total domestic energy production in 2018 (International Energy Agency, 2020) - thus offering insight into how carbon-intensive regions are struggling with the prospect of decarbonization. Third, Estonia is a *de facto* world leader for one particular technology, and one particular energy resource, oil shale. Estonia has only 0.5–1.0% of the world's oil shale reserves, but the country mines more than 48% of the world's total oil-shale output (Gavrilova et al., 2010). Our study thus shows how countries largely dependent on one form of energy seek to endorse, or prevent, attempts at diversification. Fourth, our study is one of the first to examine issues of energy injustice in the media, an approach utilized only nascently so far within the community of scholars doing energy or climate justice work (see Ivaturi & Bhagwatwar, 2020; Walker et al., 2019; Żuk & Szulecki, 2020).

The article is structured as follows.Section 2 provides a brief overview of insights from energy justice and transitions literature which are used to construct the theoretical framework of the paper. Section 3 outlines the research design: a content analysis of the coverage of 'matters of concern' related to the generation, distribution and use of energy in Estonian media during 2020, combined with additional evidence from policy reports and academic studies to provide broader context. We also briefly describe the background of the case. Section 4 presents the main results. We begin by offering an inductively developed typology of energy injustices, gathering 214 different incidents mentioned in the media under 21 categories, which, in turn, are further reduced to 5 clusters. In section 4.2 we map this typology on multiple scales and time horizons in order to provide a comprehensive overview of the variety of interrelated and contradictory issues that policymakers need to wrestle with when attempting to steer the Estonian energy transition. Section 4.3 then uses the notions of regime optimization, regime destabilization and niche acceleration injustices to manage this complexity, connecting different types of injustices to transition dynamics. For illustrative purposes we also offer three stylized media narratives, each stressing a particular type of transition-related injustice while neglecting others. Section 5 summarizes the findings and offers four conclusions directly following from the particular theoretical perspective advanced in the paper.

2. Theoretical framework

Our theoretical framework is inherently interdisciplinary synthesizing insights from energy justice as well as the spatial and temporal dynamics of sustainability transitions. We begin by summarizing the core features of energy justice literature, highlighting its recent advances and outstanding limitations. Building on the latter, section 2.2 summarizes the main features of an influential framework (Multi-level Perspective) on sustainability transitions, followed by a synthesis where we draw on energy justice and MLP to offer a more comprehensive mapping tool for energy injustices.

2.1. Energy justice and injustice

Energy justice refers broadly to conceptual approaches that seek to unveil inequalities, inequities, marginalization or vulnerability in energy transitions. As such it is an explicitly normative analytical framework that often focuses on three types of injustices:

"First, distributional justice refers to distribution of benefits and burdens across populations, and an objective to ensure that some populations do not receive an inordinate share of the burdens or are denied access to the benefits. Second, procedural justice focuses on who is included in energy decision-making processes and seeks to ensure that energy procedures are fair, equitable and inclusive of all who choose to participate. Third, recognition justice requires an understanding of historic and ongoing inequalities, and prescribes efforts that seek to reconcile these inequalities" (Carley & Konisky, 2020, p. 570).

Another study identifies four key themes of energy justice (Sovacool et al., 2016):

- The distribution of costs, or how the hazards and externalities of the energy system are disseminated throughout society;
- The distribution of benefits or fairness of structures of ownership, which determine how fairly access to modern energy systems and services are distributed throughout society;
- Equitable and representative procedures, which seek to ensure that energy decision making respects due process and representation;
- Appreciating vulnerability and recognition, or assessing the impact of energy systems on the particularly disadvantaged groups such as the poor, vulnerable, or marginalized.

Further extending this logic, an energy *injustice* would be any decision, plan, technology, or policy that inequitably distributed costs; had disparities in access or unfair ownership patterns; did not respect free prior informed consent or due process; and/or worsened some form of vulnerability within society. Issues of both governance and process, and recognition and vulnerability, can arise not only with technologies or policies but also media discussions, where broader discourses can embed injustices (e.g., environmental racism after a disaster, see Sovacool et al., 2020b), construct notions of energy poverty (e.g. in the Global South, see Debnath et al., 2021), or shape the social desirability or legitimacy of particular options (e.g., wind power in the United States, see Stephens et al., 2009).

In a recent systematic literature review, Jenkins et al. (2021) note that energy justice has broadened to reflect concerns for evaluating where injustices emerge, which processes exist for their remediation,

different prohibitive and affirmative principles and calls to combine climate, environmental and energy justice under the banner of 'just transitions' (Le Billon & Kristofferson, 2019). Others have proposed to include additional notions of justice such as restorative and cosmopolitan justice referring to aims to rectify existing injustices, and impacts of actions in one country on people in other countries respectively (Heffron et al., 2021), to extend the notion of justice to non-humans in order to avoid the anthropocentric bias of energy justice thinking (Sovacool et al., 2017), or to look at the "embodied energy injustices" and "sacrifice zones" related to the supply chain for a particular energy source, such as coal (Healy et al., 2019).

Another strand of research has stressed the need to adopt a multi-scalar perspective on energy justice (Healy & Barry, 2017; Sovacool et al., 2019, 2020a) because low carbon transitions are geographically-constituted processes (Bridge et al., 2013) including interconnections across regional, national and international scales (Grandin & Haarstad, 2020). This is particularly true for regions heavily reliant on carbon-intensive industries and fossil fuel production where those negatively affected will be individually and locally bound. Holistic injustices can severely retard energy transitions as unemployed industrial workers (as well as those benefiting from their value creation) can become a formidable voting bloc against transitions. International developments and national policymaking can also create or amplify existing regional inequalities (e.g. international environmental regulation affecting the economic viability of energy production in certain regions), whereas regionally-bounded energy systems can often have broader negative externalities (via carbon emissions or pollution).

Despite these recent advances existing energy justice literature continues to suffer from three shortcomings. First, most studies tend to be case-based, often simply producing extensive lists of injustices (see Sovacool, 2021, for a recent review of 20 years of scholarship at the nexus of geography, justice, and transitions on this point). Secondly, energy justice work frequently focuses on inequality between different demographic or socioeconomic groups; studies that explore types of inequality in other dimensions (such as the natural environment, technology design, or policy) are rarer (Bouzarovski & Simcock, 2017; Bouzarovski, 2018; Jenkins et al., 2020). Third, save for a few exceptions (Jenkins et al., 2018), most energy justice work remains disconnected from frameworks conceptualizing how low-carbon transitions occur (Köhler et al., 2019).

2.2. The multi-level perspective on socio-technical transitions

Whereas energy justice is occupied with normative concerns, MLP focuses on conceptualizing how transitions, i.e. 50-100 year shifts from one socio-technical system to another, occur. The notion of 'socio-technical system' refers to a configuration of actors, rules and technologies for the fulfilment of a particular societal function such as energy provision, food production or transportation. These systems consist of an interdependent and co-evolving mix of technologies, supply chains, infrastructures, markets, regulations, user practices, and cultural meanings (Geels et al., 2017), thereby encompassing production, distribution and consumption activities. For example, a system of personal land-based transportation entails the mutual alignment of vehicles, road infrastructure, repair shops, dealer networks, production facilities, traffic regulation, users' driving routines and symbolic meanings of the automobile (Geels, 2005, p. 147). By explicitly incorporating political, social and cultural dimensions this approach enables a considerably more nuanced understanding of the dynamics systems change than allowed by a more conventional techno-economic framing.

MLP proposes that transitions come about through interrelated processes on three levels: niche, regime and landscape (Geels, 2005). Regime refers to existing socio-technical systems that are strongly path-dependent and resistant to change. Such systems are maintained, defended, and incrementally improved by incumbent actors, whose actions are guided by deeply entrenched and interrelated rules (aka 'regimes'). Niches are emerging social or technical innovations that differ radically from the incumbent regime, but are able to gain a foothold in particular applications, geographical areas, or markets (e.g., the military). The socio-technical landscape refers to broader contextual developments that influence the socio-technical regime and over which regime actors have little or no influence. Landscape developments comprise both slow-changing trends (e.g., demographics, ideology, geopolitics) and exogenous shocks (e.g., wars, economic crises, major accidents, political revolutions).

Transitions can be divided in three phases. In the start-up phase landscape changes destabilize the incumbent regime which is unable to find an internal solution to its problems. This, in turn, provides a 'window of opportunity' for niches that start to develop through mutually supporting processes of resource mobilization, social learning and alignment of expectations between multiple actors (Raven & Geels, 2010). In the acceleration phase the regime becomes further destabilized prompting increased niche-niche and niche-regime interactions that, depending on the context, can be more or less competitive in nature. Through a process of gradual scale-up and alignment different niche solutions come to constitute the new regime in the stabilization phase, transforming the basic architecture of the system (see Fig. 1). Depending on the degree of landscape intensity, regime resilience and niche maturity transitions can occur through various pathways, e.g. substitution, de-alignment and re-alignment, transformation or reconfiguration (Geels & Schot, 2007). In certain conditions, when landscape pressure is either absent or too short in duration, transitions might also fail to occur, resulting in further regime optimization along the path of incremental innovation (Kanger, 2021; Wells & Nieuwenhuis, 2012).

2.3. Synthesis: connecting energy justice and transitions dynamics

Based on the foregoing discussion we conclude that whereas energy justice is strong on the mapping of normative issues, it does not have a particularly developed theory of change, e.g. models explaining how various injustices interact over time, the various outcomes of these interacting injustices or the dependence of these interactions and outcomes on broader background factors. MLP, on the other hand, offers a conceptual model of how transitions occur but has not developed a specialized vocabulary to handle various forms of injustice. In this section we therefore attempt a tentative synthesis of the insights of these literatures. This leads to the development of a new and more expansive mapping tool for various injustices; as we argue, it also requires tailoring the conceptual language of energy justice to MLP.

The starting point of the discussion are the injustices by fundamental "forms" or "tenets" of justice such as distribution, recognition, and procedure (Bouzarovski & Simcock, 2017; Sovacool et al., 2019; McCauley et al., 2019). Taking stock of the most recent advances in the energy justice literature, we propose to map two additional aspects: 1) we adopt a multi-scalar perspective by distinguishing between injustices operating on regional, national and international level. This enables to address the spatial dimension of cosmopolitan justice, i.e. impacts of actions in one region on other ones (Heffron et al., 2021); 2) we also record the occurrence of environmental impacts with no clear justice implications for particular social groups. In this way we seek to address the anthropocentric bias of most of energy justice literature.

Existing energy justice literature has already highlighted that energy justices will change over time, as costs and benefits are temporally distributed at different time-scales, from immediate or proximate issues such as jobs or air pollution to intergenerational issues such as species loss or the storage of nuclear waste (Sovacool et al., 2019). What the Multi-level Perspective adds to this picture is the role of promises and expectations in shaping transitions. That is, envisioned impacts of energy transitions and the accompanying inequalities are not neutral projections about the future but often means for shaping current energy policy (Hermwille, 2016; Rosenbloom, 2018). In other words, the highlighting and neglect of particular inequalities by certain groups (e.g.

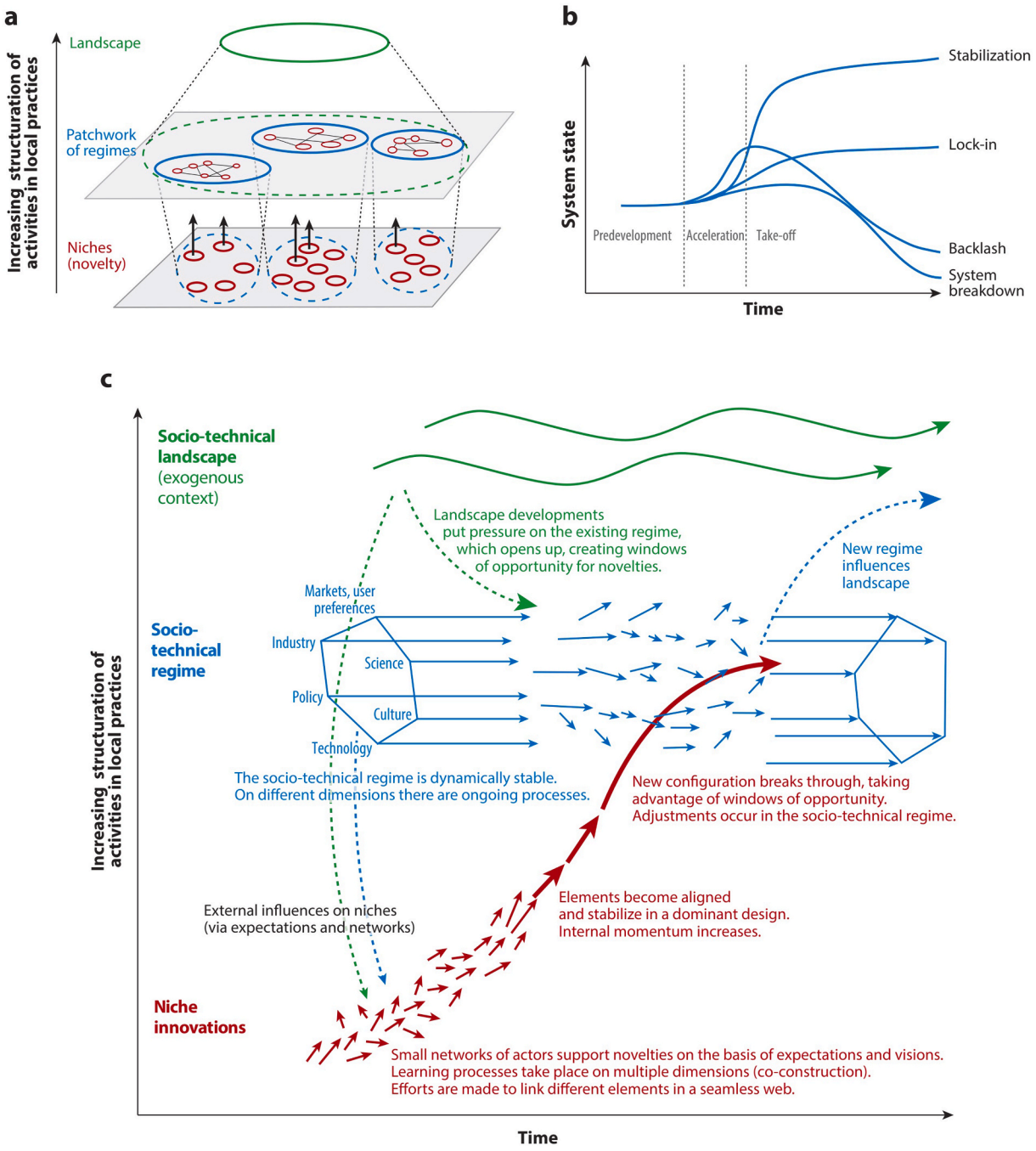

Fig. 1. The multi-level perspective on socio-technical transitions.
Source: Loorbach et al. (2017). The original multi-level, multi-phase perspective on transitions with (a) the multi-level model depicting the relation between landscape, socio-technical regimes, and niches; (b) the multi-phase concept illustrating the non-linearity of transitions and different types of pathways, and (c) socio-technical transition as result of co-evolving landscape pressures, destabilization of the focal regime and emerging niches over time.

entrepreneurs, green movements) can be seen as a discursive power struggle on who gets to "colonize" the future. It is therefore crucial to introduce a distinction between currently experienced and anticipated injustices, opening a door for a multi-horizon analysis of energy injustices.

We therefore propose a multi-scalar and multi-horizon framework of energy injustice consisting of three spatial scales (regional, national, international) and three time perspectives: 1) the 'now' dimension which refers to already experienced injustices; 2) the 'now to later' dimension referring to emergent trends the continuous unfolding of which is expected to lead to increased injustices in the future; 3) the 'later' dimension which refers to injustices that might occur sometime in the future. Table 1 provides an overview of the framework, including examples from each type of injustice.

Whereas the distinction between recognitional, procedural and distributive injustices is one of the pillars of energy justice, these categories do not provide a straightforward connection to transition dynamics as described by MLP. It is highly likely that these three forms on injustice characterize various niche-regime interactions throughout the entire transition. Furthermore, specific events part of broader transitions, such as the introduction of new sources of energy or announcing a plan for a just transition, simultaneously create recognition-related,

Table 1
A multi-scalar and multi-horizon framework for evaluating energy injustice.

	Now ("it is already happening")	Now to later ("if current trends continue it will only get worse")	Later ("it might happen sometime in the future")
International (macro scale)	Uneven circulation of intellectual property and patents for low-carbon innovation	Mounting externalities for electronic waste	Disruption of global markets for fossil fuels or carbon intensive products
National (meso scale)	Displacement of air pollution	Lock-in of uneven development	Risk of a major nuclear energy accident
Regional (micro scale)	Local employment	Protests, strikes, and rising populism	Bankruptcy of firms or mass migration

Source: Adapted and expanded from Sovacool et al. (2019).

procedural and distributive injustices. In order to overcome these problems we therefore propose to reconceptualize the basic forms of justice in direct connection to the MLP model. From this perspective transition governance needs to navigate through the following trilemma:

- **Regime optimization injustices**: injustices characterizing the current regime that might be maintained and even further amplified through the process of incremental improvement. As these injustices are often extrapolations of already experienced problems (e.g. health or pollution impacts) the associated trends can be determined with a fairly high degree of certainty.
- **Regime destabilization injustices**: injustices that result from destabilizing the dominant regime. This includes both direct effects (e.g. some enterprises going out of business) and broader repercussions (e.g. structural unemployment in the region).
- **Niche acceleration injustices**: injustices that result from the introduction, scale-up and alignment of niche innovations into a new regime, involving both niche-regime and multi-niche competition (e.g. government support for one type of niche might harm the prospects of other niches).

In the following sections we show how these insights can be used for a more comprehensive mapping of energy injustices and for connecting various injustices to transition dynamics.

3. Research design

3.1. Case selection, data collection and analysis

We apply our framework to injustices around the ongoing energy transition in Estonia, a country which is globally unique in its large-scale reliance on a highly carbon-intensive oil shale based energy system. Our research design grew out from our initial focus on Ida-Virumaa, a region in North-Eastern Estonia which is heavily specialized on oil shale. However, in the early stages of research we realized that debates on the current regional situation and its future cannot be viewed independently from country-level developments and international trends in energy production as well as debates on its future. Therefore, the scope of analysis was extended to include additional levels and time horizons. The Estonian case is also inherently valuable as studies on energy transitions in post-communist countries remain relatively rare.

In order to demonstrate the applicability of the multi-scalar and multi-horizon framework while keeping the research feasible we chose a 'snapshot' approach, mapping the injustices of the Estonian energy system in 2020 can be viewed as a critical juncture in many ways: on one hand, the share of oil shale in Estonian energy system has been sharply dropping in recent years (see section 3.2), raising major concerns about structural unemployment. On the other hand, with the increasing prominence of the theme of Just Transition on the EU level, one would also expect proactive regional renewal to be discussed more explicitly by Estonian policymakers, entrepreneurs and NGO-s. Furthermore, the conjunction of external economic and regulatory pressures (profitability of oil shale based energy production, EU's environmental policy) and the fragility of the dominant system, e.g. oil shale's low Energy Return of Investment (Hall et al., 2014), means a 'window of opportunity' for enacting a full-scale transition of the Estonian energy system. The outcomes of present framing struggles and political decisions based on those struggles can thus have a large impact on the Estonian energy future.

Data on injustices was primarily collected through a content analysis (Krippendorff, 2018) of news articles and editorials on the Estonian energy system. We chose to focus on media coverage because it enables to provide a continuous and detailed overview of multiple unfolding and interacting public controversies around specific issues (see Walker et al., 2019; Sillak & Kanger, 2020, for examples of such analyses on energy justice in Canada and the destabilization of Estonian oil shale industry respectively). Our primary source of data was Postimees, one of the three biggest daily newspapers in Estonian media market, non-partisan in terms of its contents and editorial policy, and hence deemed a representative platform of public discourse.

Data collection and analysis was carried out by a native speaker. Article search was conducted in three rounds: 1) "põlevkivi AND õigl*" and "õiglane üleminek" ["oil shale AND just*" and "just transitions"] were first used to detect articles speaking about oil shale in the context of justice; 2) "põlevkivi/tuule*/tuuma*/päike*/bio* AND energ* AND mõju" ["oil shale/wind/nuclear/solar/bio AND energ* AND impact"] were then used to locate articles on various impacts associated with the dominant system and the emerging niches; 3) specific keywords such as "põlevkivi", "tuulik", "päikesepark", "tuumajaam" and "graanul" ["oil shale", "wind turbine", "solar park", "nuclear plant", "granule"] were used to detect texts missed in the previous rounds. Additional search terms "energiavaesus" and "elektri hind" ["energy poverty", "price of electricity" were used to find texts focusing on accessibility issues. Altogether 102 news items, long reads and opinion pieces were included in the analysis.

Each article was subsequently coded according to a coding manual which included general characteristics of the texts (e.g. date, title, author) and four theory-driven categories (basic type of injustice, its time horizon, scale of injustice and related aspect of transition, see Appendix A). Since justice was seldom explicitly mentioned our mapping focused on locating 'matters of concern', i.e. any problematic issue raised by any actor in relation to energy production, distribution and consumption. The expression of a concern was used as a proxy for identifying the underlying injustice-related issue. Furthermore, in order to bridge the gap between highly abstract theoretical categories (e.g. recognitional, procedural, distributive justice) and the detailed description of specific issues in the articles we also developed an inductive middle-range typology of injustices. This was constructed in an interative fashion, including constant additions to the coding scheme, merging of certain codes and re-coding of articles where necessary. The final typology included 214 incidents of injustice gathered under 21 different categories, which were further reduced to 5 clusters (see section 4.1). The preliminary analysis of the counts and frequencies of different issues was carried out in Excel. Finally, selected policy documents and prior studies were used to provide broader context for the case (see section 3.2) and to interpret the findings. We also used the lists of existing impacts and desired goals in national development plans (e.g. Keskkonnaministeerium, 2015, pp. 29–35; Majandus-ja Kommunikatsiooniministeerium, 2017, pp. 82–83) for selective checks of whether media coverage had been sufficiently inclusive of various issues. This confirmed that the issues mentioned in the development plans were indeed included in our typology.

Our approach has several limitations. Admittedly, the matters of

concern are self-identified: they are what a person, institution, or story perceives to be problematic. In some ways this can be seen as a strength, as it adheres to principles that treat everyone as equals meaning their perceived injustices have validity even if they are not regarded as injustices by other groups—our approach adheres to the principle of "fairness," "plurality," and "recognition" in this regard (Light and De-Shalit, 2003; Honneth, 2004; Anderson & Honneth, 2005; Craig et al., 2008; see Sovacool et al., 2019, for a mapping exercise following this principle). This point also underscores how injustices are relational—what one may experience as an injustice is not necessarily experienced as such universally or across other actors. However, this approach assumes that all injustices are voiced in good faith and that the voices of all significant actor groups are, in fact, present in media coverage. An important limitation of our research design is thus vulnerability to purposeful attempts to raise false concerns and to the substantive omission of certain groups whose concerns have not been represented by any actor. In order to alleviate these concerns we have refrained from prioritizing particular injustices based on their relative frequency (as elites can have a better access to media) and checked our list of injustices against some policy documents (see above). Secondly, the move from a matter of concern to underlying injustice in the coding process results from an interpretative choice of the researcher and as such entails a certain degree of subjectivity. Thirdly, as coding was carried out by one researcher no inter-coder reliability checks have been performed. Finally, as our analysis explicitly focuses on injustices stemming from perceived problematic issues we do not attempt to assess the benefits of different energy futures.

3.2. Estonian energy system: background

Since the post-World War II era Estonia's energy system has been predominantly based on oil shale enabling the country to rely on domestic sources for energy supply, and to become a world leader in one sub-sector of the global energy regime. In 2018, oil shale accounted for 72% of Estonia's total domestic energy production, 73% of total primary energy supply and 76% of electricity generation (International Energy Agency, 2020). However, recent increases in EU's carbon quota have seriously undermined the profitability of oil shale based energy production. In 2019 the share of oil shale in energy production dropped from 76% to 57% (Statistikaamet, 02.09.2020) and a few percentages more in 2020 while still remaining above 50% (Elering, 26.01.2021). All oil shale mining areas as well as the main power plants are situated in Ida-Virumaa, a North-Eastern part of the country with a predominantly Russian-speaking population. The two key industry actors are Viru Keemia Grupp, a privately-owned enterprise focusing on oil shale mining, shale oil based fuels and chemicals, and combined heat and power production; another one is the state-owned Eesti Energia, a main energy supplier in Estonia also operating on international markets for electricity, gas and liquid fuels.

The problems of oil shale based energy system are well known, including harmful impacts on wildlife (e.g. landscape changes, loss of biodiversity), air (noise, fine particles), surface and ground water (including the scarcity of drinking water), waste generation (about 80% of total waste in Estonia is generated by the oil shale sector) and the health of workers and citizens in the region (e.g. the higher than average incidence of lung cancer and chronic diseases) (Keskkonnaministeerium, 2015; Idavain et al., 2020). Due to the impact of oil shale industry, Estonia has one of the highest ecological footprints per capita (Global Footprint Network, 2017) and is one of the highest emitter of greenhouse gases per capita among OECD countries (OECD, 2021). However, during the last decades these issues have been countered in public debate by references to energy security and the threat of unemployment in Ida-Virumaa (Sillak & Kanger, 2020). These themes remain salient given that the recent drop in oil shale production has not been compensated by domestic alternatives, meaning that from 2019 Estonia has shifted from net exporter to net importer of electricity (Postimees, 25.07.2019).

The share of renewables in the Estonian energy mix has been steadily rising, reaching 2229 GWh in 2020 (46.4% from domestic supply and 25% from final consumption). The largest share (56%) belongs to biomass, biogas and waste, followed by wind (37%) and solar (5%) with the latter having doubled in one year (Elering. 26.01, 2020). Major players in alternative energy are Eesti Energia, particularly its sister company Enefit Green, holding a large share in Estonian wind energy market but also being involved in solar, bioenergy, waste and hydropower. Graanul Invest is currently one of the biggest wood pellet producers in Europe, exporting more than 98% of its production with United Kingdom, Denmark, Italy and the Netherlands as its main markets (Ärileht. 30.06, 2020). Finally, a recently formed Fermi Energia has strongly started to lobby for building a small modular nuclear reactor in Estonia.

The historical evolution of Estonian energy policy has been largely characterized by two tendencies. On one hand, the policymakers have often attempted to "hedge the bets" in order to support the oil shale sector while conforming to international environmental agreements. For example, at the end of 2015 the Paris accord on climate change and a new national oil shale development plan were approved by the government in the same week (Sillak & Kanger, 2020). On the other hand, this strategy has forced policymakers to resort to reactive measures when oil shale industry experiences problems, e.g. providing consultation, retraining and subsidies for workers in Ida-Virumaa after major layoffs by Eesti Energia and VKG in 2015, 2016 and 2019, making the taxation of oil shale sector dependent on global oil prices to protect it against volatility (2018), or subsidizing the burning of biomass in Narva power plants to keep them operating (2020). The shift from reactive to proactive stance has started to gather strength only recently, at least partly in connection to the Just Transition rhetoric and the promise of additional EU funding.

4. Results and analysis

Here we present our results of injustice mapping. Section 4.1 first summarizes the three tenets of energy justice to provide an overview of how the Estonian case looks like from the conventional energy justice perspective. In order to bridge the gap between abstract categories and specific issues we then present our inductive typology, consisting of 214 incidents of experienced and anticipated energy injustices across 21 different categories, further reduced to 5 clusters. Using these clusters and categories section 4.2 introduces the full results of our multi-scalar and multi-horizon mapping, demonstrating the complex landscape of interconnected injustices that policymakers need to navigate in order to steer the Estonian energy transition towards sustainable and just directions. To reduce the resulting complexity of this depiction section 4.3 uses insights from MLP to structure these injustices according to their connection to particular transition dynamics. This leads us to a sketch of particular narratives advocated by different actor groups, based on which types of injustices have been highlighted (and which ones neglected).

4.1. An inventory of Estonian energy injustice

We start our overview of the Estonian case by focusing on the three core injustices as commonly highlighted in existing literature on energy justice (see section 2.1). From 102 articles we identified 110 instances of recognitional, procedural or distributive injustices and a further 8 where the type could not be clearly identified. *Recognition issues*, mainly related to the exclusion of regional citizens from discussions on energy futures, are relatively uncommon (10 or 8.5%). The presence of such recognitional issues nevertheless reveals how energy transitions can negatively affect acutely vulnerable groups within Estonia. *Procedural issues* are slightly more common (14 or 11.9%), including the contestation of procedures providing unfair competitive advantage to certain

enterprises, countries or regions, and superficial inclusion of local citizens to the planning of energy production facilities. These issues emphasize that policy and governance issues can couple with technological systems to disseminate injustices. *Distributive issues* dominate the sample (86 or 72.9%), covering issues like environmental degradation, worries about industrial and regional decline or the socialization of economic risks. The presence of these issues reminds us how transitions create winners and losers and also that the range of impacts can cascade across scales (from the local to the global) as well as dimensional types (impacting non-human species and the environment alongside human impacts).

In order to provide more insight to specific issues highlighted in the media, Table 2 shows our inductively developed typology clustered along different themes of injustice. Note that because of rounding the percentages do not add up to 100.

17 categories can be further grouped into four thematic clusters covering more than 75% of the coded injustice incidents. The environmental cluster (1) with a share of 18.7% focuses on environmental injustices. *Direct harmful environmental impacts* of energy production relate not only to oil shale (biodiversity problems, carbon emissions), but also nuclear power (embodied carbon in construction) and biomass (carbon emissions and poor conversion efficiencies). Wind energy production is seen as resource-intensive, solar energy as land use intensive, and wood pellets to have deleterious effects on forest ecosystems because of rapid felling. Another category of environmental threats is related to *air and soil pollution,* notably benzene and particulate pollution in Ida-Virumaa (oil shale), alteration of soil hydrology (wind energy), or the environmental impacts of uranium mining (nuclear power). Specific *impacts on wildlife* were also articulated, including that wind energy can disrupt seals, bats and the migratory paths of birds, that construction noise affects fish populations, or that wind farms can interfere with the habitats of rare or endangered species.

Economic cluster (2) with a share of 23.3% focuses on the chains of impacts set in motion by actions either supporting or undermining particular industries. *Harmful effects of industrial destabilization* include not only the loss of high-paid jobs, lower wages, unemployment, and the migration of skilled labour from Ida-Virumaa as oil shale is potentially phased out; knock-on effects identified also include the regional collapse of ancillary businesses (e.g. cinemas, supermarkets, restaurants), a loss of the tax base, and decreases in technological skills, especially if shipping fuels (currently produced from oil shale) come to be manufactured instead outside of Europe. *Spill-over effects resulting from the combination of regulatory conditions and economic incentives* remain a contentious matter. For example, the government's planned approval for using wood waste in oil shale boilers might further stimulate deforestation as do EU subsidies for biomass energy. Another dimension of injustices relate to *uncertain knock-on effects* for specific industrial or economic sectors, notably tourism (wind energy can interfere with undisturbed sea views in islands), marine shipping (offshore wind can interfere with shipping lanes for heavy ships), and agriculture (all energy systems can compete with available farming land). There are also worries that *subsidies for current energy production might harm the prospects of alternatives.* For example, continued support for oil shale might crowd out renewables and prolong the lock-in of Ida-Virumaa to unsustainable industrial activities. However, this also applies to renewables as continued subsidies to pellet production are feared to hinder investment in industrial facilities permitting a higher value added use of wood.

Political cluster (3) with a share of 20.0% focuses on already existing or anticipated unfairness resulting from political decision-making (or the lack of it). This includes perceived violations of the principles of *fair competition*, such as freeriding by energy and fuel producers external to the European Union who would not be subject to as stringent environmental regulation as Estonian entrepreneurs; worries expressed by the oil shale industry that Green Deal prematurely undermines the competitiveness of Central and Eastern European industries, or claims from wind energy producers about the preferential treatment of Eesti Energia by the state. Another issue is related to *unfair compensation.* For example, Martin Helme, Minister of Finance at the time, claimed that oil shale was initially excluded from EU's Just Transition plans saying that "Basically at present the just transition fund is not just" (Postimees, 19.02.2020). Others discuss the *unfair use of* funds, including schemes to take advantage of solar park subsidies, fears that Just Transition funding would be used for regions other than Ida-Virumaa or for indirectly subsidizing the oil shale industry. Related to the latter are the ongoing fears about *non-transparent political procedures*: for example, after the start of the COVID-19 pandemic the government rapidly approved a 125 million EUR investment to a new shale oil plant, a move contested by scientists and environmental movements on the grounds of lacking both public justification and compatibility with EU's climate goals. Finally, *uncertainty from policymakers* is a theme common to different parties (oil shale industry, Ida-Virumaa region, renewable industry), citing the lack of a clear political strategy as an obstacle for any future activities.

Table 2
Count and frequency of energy injustices mentioned in our sample of media coverage.

Cluster	Energy justice: matter of concern	Count	% from total
1 (Environmental)	1. Direct harmful environmental impacts of energy production	22	10.3
	2. Air/water/soil quality	7	3.3
	3. Harmful impacts on wildlife	11	5.1
2 (Economic)	4. Possibly harmful or uncertain knock-on effects of industrial destabilization	20	9.3
	5. Various spill-over effects of the combination of supporting regulatory conditions and economic incentives	16	7.5
	6. Possibly harmful or uncertain knock-on effects of new energy production facilities	6	2.8
	7. Subsidies for current energy production harm the prospects of alternatives	8	3.7
3 (Political)	8. Fair competition principles violated: freeriding by actors external to the EU	5	2.3
	9. Fair competition principles violated by the EU	6	2.8
	10. Fair competition principles violated by the state	8	3.7
	11. Fair compensation principles violated	6	2.8
	12. Unfair use of EU and state funds	5	2.3
	13. Non-transparent political procedures	4	1.9
	14. Uncertainty from policymakers	9	4.2
4 (Societal)	15. Socialization of economic risks	9	4.2
	16. Intergenerational justice	12	5.6
	17. Unfair shifting of environmental burdens from one country to another	12	5.6
5 (Other)	18. Defence and security risks	23	10.7
	19. Harmful health impacts	7	3.3
	20. The interests of local communities have not been taken into account in a sufficient manner	8	3.7
	21. Aesthetic and cultural concerns	10	4.7
		Total: 214	**Total:** 99.8

Source: Authors.

Societal cluster (4) with a share of 15.4% is explicitly occupied with the uneven societal distribution of different burdens in different directions. This includes the unjust *socialization of economic risks*, e.g. fears that continued support for oil shale places a high risk on tax payers who need to compensate potentially failing investments and effectively pay a premium for electricity in order to keep the people in Ida-Virumaa employed. Another category involves *intergenerational justice*, reflecting the concerns that present monetization of Estonian forests or the full costs of the envisioned nuclear plant will be shifted to future generations. Related to this are worries about the *unfair shifting of environmental burdens from one country to another*. For example, in August 2020 an environmental movement Eesti Metsa Abiks sent a public letter to Dan Jørgensen, Danish Minister of Climate and Energy and Public Utilities, to remind that Estonian forests are currently used to fulfil Denmark's green energy quota.

Cluster 5 with share of 22.4% is a leftover category (hence labelled 'Other'), with national *defence and energy security risks* constituting a considerable majority (10.7% of the total). This includes claims that substituting oil shale and introducing nuclear would decrease energy independence, concerns about the continued security of supply, but also claims of unfair treatment by entrepreneurs whose attempts to gain permissions for wind energy parks have been turned down by the state on the grounds that the turbines would block radars. *Negative impacts on health* (3.3%) include a range of identified risks as well. Oil shale is discussed as contributing to lung cancer, chronic diseases (asthma, allergies), childhood pneumonia or bronchitis. Nuclear power is discussed for its links to radiation, stress of living near nuclear facilities, lung cancer, endocrine system disruption and leukaemia from uranium mining. Even wind energy is mentioned as having health concerns related to noise and vibration. Concerns about *insufficient inclusion of local communities* (3.7%) are also stipulated. Wood pellets are seen to erode the protection of the rights of indigenous people (Seto people in South-Eastern part of Estonia) and felling plans of forests have only partly been introduced to people in certain regions (Treimani, Metsapoole, Ikla-Oandu). Local communities have heard about plans for some wind farms but have not been included in planning or licensing (Kihnu, Saaremaa). Finally, *aesthetic and cultural concerns* (4.7%) have been expressed about the visual impact of wind energy but also about the impacts of oil shale phase-out on the industrial identity of Ida-Virumaa.

4.2. A multi-scalar and multi-horizon mapping of Estonian energy injustices

Having provided a summary overview of the main clusters and categories of our typology, we now move on to show how the various injustices are placed along different spatial scales and temporal horizons. The results are presented in Table 3. Overall, we find that the injustices were almost evenly split between regional (44 or 35.8%) and national (48 or 39.0%) scales. The international scale was present, but less frequent (18 or 14.6%). The scalar attributes of some injustices could not be determined (13 or 10.6%). Given the general orientation of Postimees and the concentration of energy production in Ida-Virumaa the prevalence of regional and national concerns is not surprising. Within the sample, anticipated injustices (54 or 53.5%) are far more frequent than experienced (29 or 28.7%) or ambiguous cases in which both time perspectives are implicated (18 or 17.8%).

Overall, the combined findings – a majority of injustices being distributive, national/regional and focused on the extrapolation of current trends – confirm insights from sustainability transitions literature on the role of framing in shaping system shifts (Hermwille, 2016; Rosenbloom, 2018). Indeed most injustices are invoked in relation to particular energy sources with general issues being raised much less frequently. Interestingly, indecisiveness of national policymakers seems to be an exceptional common ground for the advocates of various energy sources. On one hand, this further illustrates ongoing struggles by various actor coalitions to shape the future of the energy system; on the other hand, it provides support for the claim that policymakers still favour "hedging the bets" strategy (Sillak & Kanger, 2020). Table 3 also provides a nice illustration of why this is the case: not only do policymakers need to find a way to balance the interests of groups appealing to different injustices, they also need to take into account both existing and anticipated injustices in the context where information about the realization of future injustices is plausible yet (sometimes) highly uncertain and non-quantifiable. This creates a vicious cycle: by failing to choose a clear direction policymakers communicate institutional uncertainty to entrepreneurs. The latter, in turn, face difficulties with choosing a suitable line of action (e.g. investments in particular energy production facilities). Differing responses by the energy industry then end up sustaining current uncertainty, making it difficult for the policymakers to proceed with decisive action. As a result policymakers are forced to deal with various injustices in a reactive rather than proactive manner.

4.3. Injustices and transition dynamics

Until now we have used MLP to create a more comprehensive description of energy injustices, extending to multiple scales and time horizons. Although our mapping tool has enabled a structured approach the complexity of the mapping remains high, raising questions on how to make sense and use of the findings. In this section we therefore take a further analytical step by 1) categorizing injustices identified in sections 4.1 and 4.2 according to whether they are about regime optimization, regime destabilization or niche acceleration, and; 2) connecting these injustices to transition dynamics. The results are shown in Fig. 2 which summarizes the Estonian case distinguishing between three stylized futures (re-stabilization of oil shale regime, renewable-based transition, nuclear transition). The placement of different injustices on the figure also reflects whether they are currently experienced (left) or anticipated (middle and right).

Altogether the three types of injustices were mentioned 110 times with regime optimization injustices being the least frequent (21 times, 19.1%), followed by regime destabilization (34, 30.9%) and niche acceleration (55, 50%). Most injustices were mentioned by journalists (32 with 22 or 68.8% focusing on niche acceleration), followed by scientists (26 with a fairly balanced distribution between optimization (10, 38.5%), destabilization (9, 34.6%) and acceleration (7, 26.9%) related injustices), policymakers (17 with 9 or 52.9% focusing on destabilization), 'other' (16 with 11 or 68.8% focusing on niche acceleration), renewable energy industry (10 with 7 or 70% focusing on niche acceleration) and oil shale industry (9 with 7 or 77.8% focusing on destabilization). The dominance of niche acceleration injustices is not surprising given media's focus on emerging issues and the variety of niches themselves. In 2020 debate around alternative energy was mainly fuelled by debates about wind energy parks, concerns about the sustainability of biomass and the possible hazards of nuclear power.

Based on what kind of injustices have been raised (and which ones fairly neglected), we can distinguish between three stylized media narratives. A narrative of "Caught between the wheels" (pro oil shale, focusing mainly on regime destabilization injustices) argues that the combined pressure of unjust taxation from the EU plus freeriding from external countries has undermined the competitiveness of Estonian oil shale industry, first by squeezing out energy production and now threatening to do the same with fuel production. The effects will not be only be felt by the industry and Ida-Virumaa: broader knock-on effects will affect the country as a whole through various means, both economically (e.g. decreasing competitiveness) and politically (e.g. increasing security risks). The solution lies in continued support for the oil shale industry at least until 2040 and in the gradual upgrading of regional capabilities. Whereas the strong version of this narrative is unsurprisingly supported by the oil shale industry a more moderate version, highlighting mainly the need to prevent regional decline, maintain Estonia's knowledge base in oil shale and technological skill base in mining, is also supported by some policymakers and scientists.

Table 3
A multi-scalar and multi-horizon matrix of Estonian energy injustices.

	Now ("it is already happening")	Now to later ("if current trends continue it will only get worse")	Later ("it might happen sometime in the future")
International	**1–1:** Rapid carbon emissions through burning (biomass) **2–5:** EU support to bioenergy increases low-efficiency biomass burning, deforestation and relaxation of environmental regulations (biomass) **3–8:** cheap but 'dirty' energy from Russia, insufficient commitment to climate neutrality by Third World countries **3–9**: EU's Just Transition related compensation to Estonian miners, oil shale industry and CEE countries either excluded or insufficient (oil shale) **4–17:** biomass import by Western European countries effectively externalizes the environmental impacts of bioenergy (biomass)	**3–9:** Green Deal and carbon tax undermine the competitiveness of Eastern European industries, effectively harming countries that have reduced emissions quicker (oil shale)	**1–2:** harmful environmental impacts of uranium mining (nuclear)
National	**1–1:** High carbon emissions and waste (oil shale) Increasing deforestation, loss of biodiversity (biomass) **1–3:** decreasing bird population (biomass) **2–7:** subsidies hinder the use of wood for higher value added economic activities (biomass) **3–10:** Adverse impacts of the state's environmental taxation on industrial competitiveness (oil shale) Denials to build wind energy parks amount to unfair treatment of energy producers (wind) **3–12:** Investments in oil shale could have been used to alleviate the impacts of the COVID-19 pandemic instead (oil shale) Various forms of scheming by applicants to be eligible for solar park subsidies (solar) **3–13:** lack of justification for approving an investment to a new shale oil plant during the COVID-19 pandemic (oil shale) **3–14**: Conflicting commitments to climate neutrality/oil shale industry create uncertainty about the future State has not provided a clear signal to regional entrepreneurs and citizens, which might prolong current problems (oil shale) State support too low to invite investment to wind energy, uncertainty about eligibility criteria for solar creates additional work for the municipalities (wind, solar) **4–15:** nationally regulated cheap value extraction from Ida-Virumaa amounts to domestic colonialism (oil shale)	**2–4:** loss of tax income for the state, loss of technological skill base for the industry, decreasing economic growth (oil shale) **2–5:** Support for burning wood in oil shale boilers facilitates environmental degradation and deforestation (oil shale) Subsidies facilitate the entry of inexperienced providers creating installation and maintenance risks for clients (solar) **2–6:** land required for panels reduces the land available for agriculture (solar) **2–7:** continued support to oil shale crowds out renewables, prolongs regional lock-in to industrial activities, hinders regional diversification in Ida-Virumaa (oil shale) **3–10:** fears of market monopolization and preferential treatment of Eesti Energia by the state (wind) **3–12:** fears that EU's Just Transition budget will be used to support oil shale industry (oil shale) **3–13:** non-transparent allocation of Just Transition funds, fears of preferential treatment of well-capitalized enterprises (oil shale) **4–15**: Fears that incidents of energy scarcity will place an increased economic burden on final consumers Estonian tax payers absorbing the economic risk of new oil shale facilities, paying premium for electricity just to keep the people in Ida-Virumaa employed (oil shale) Fears that ultimately tax payers need to cover the environmental costs of deforestation (biomass) Estonian tax payers absorbing the economic risk of new renewable energy facilities (wind, solar) **4–17:** Estonia's sales of oil shale based fuels will effectively amount to emissions export (oil shale) **5–18:** increasing reliance on import decreases energy independence, undermines security of supply, renewables still require fossil fuels for grid stabilization (oil shale) Permission for new wind parks not granted by the state because the height of wind turbines would block radars (wind)	**1–1:** carbon-intensive construction and maintenance (nuclear) **4–16:** Failure to act now makes it worse for the future generations Monetization of forests leaves environmental degradation for future generations (biomass) Issues of waste management and monitoring, insufficient accounting of costs, fears of policy capture by entrepreneurs (nuclear) **5–18:** decrease in energy independence, possible safety issues (nuclear)
Regional	**1–1:** impacts on ground water and biodiversity (oil shale) **1–2**: air pollution, benzene, fine and extra fine particles (oil shale) **5–19**: lung cancer, chronic diseases (e.g. asthma), childhood pneumonia, bronchitis (oil shale) **5–20:** Little consideration of the rights of indigenous people, only partial introduction of felling plans to local communities (biomass) No or late inclusion of locals to the planning of wind energy parks (wind)	**1–1:** production of wind energy parks is resource-intensive, land requirements and biodiversity impacts of solar (wind, solar) **1–2:** wind turbine construction alters soil hydrology (wind) **1–3:** wind turbines disrupts seals, bats, migratory paths of birds, fish populations, the habitats of rare species etc. (wind) **2–4:** loss of high-paid jobs, structural unemployment, migration of skilled labour, loss of tax income for the municipalities, decline of regional industry and ancillary businesses (oil shale) **2–6:** disturbances of tourist industry in islands, blocking of shipping routes, fears that houses need to be demolished in order to transport turbine blades (wind) **5–18**: impacts of phase-out on regional stability (oil shale)	**4–16:** current lock-in to oil shale only increases future exit costs (oil shale) **5–19:** radiation, stress of living near nuclear facilities, lung cancer, endocrine system disruption and leukaemia from uranium mining (nuclear)

(*continued on next page*)

Table 3 (*continued*)

Now ("it is already happening")	Now to later ("if current trends continue it will only get worse")	Later ("it might happen sometime in the future")
	5–19: turbine noise might be harmful for health (wind) **5–20**: the voice of Ida-Virumaa citizens in planning for Just Transition is largely absent, state overrides municipalities about planned investments in regional renewal (oil shale) **5–21**: Phase-out would disrupt the industrial identity of Ida-Virumaa citizens (oil shale) Visual pollution, noise and landscape impacts of wind turbines, general impacts on local livelihood and islander identity (wind)	

Notes: the categorization follows the scheme introduced in Table 2, e.g. 1–3 means the third category ("harmful impacts on wildlife") from the first cluster (Environmental). The allocation of injustices to spatial and temporal scales has been performed from Estonian perspective. This means that although some injustices may already be currently present in the world, the decisions actualizing them for Estonia have yet to be made. To take a specific example: the environmental impacts of uranium mining have been allocated to the international*later cell because at present Estonia has not decided to build a nuclear power plant.
Source: Authors.

A narrative of "One should not invest in the past" (anti oil shale, focusing mainly on regime optimization injustices) notes environmental pressures and regulatory pressures are only expected to increase in the future, casting strong doubts over the viability of the oil shale industry even today. Therefore, continued support for oil shale amounts to prolonging current environmental and societal injustices without addressing the root problems of Ida-Virumaa. The solution lies in increasing support to alternative means of energy production (mostly renewables) and support for a regional diversification of economic activities in Ida-Virumaa. Whereas the strong version of this narrative is advocated by environmentalists, both stronger and weaker versions find support among scientist as many injustices of the current oil shale based regime have been well studied.

A narrative of "Why should we take the hit?" (focusing on niche acceleration injustices) supposes that although a shift to clean energy is welcome in principle it does not mean that it should take precedence over other considerations. Wind, solar, biomass and nuclear each have their specific problems that, if not properly addressed, will only become worse in the future and create new injustices, often in regions other than Ida-Virumaa (e.g. new wind parks disturbing tourist industry in islands). Regional and national debates are required in order to develop viable compromises. The strong version of this narrative is often advanced by local citizens whereas the weaker version, highlighting various emerging issues with wind, solar, biomass and nuclear, also finds support among some scientists and policymakers. Not surprisingly, renewable and nuclear entrepreneurs are prone to highlight the emerging and anticipated injustices of each other.

5. Discussion and conclusion

In this paper we have borrowed insights from sustainability transitions literature to extend energy justice literature in two directions: 1) taking into account the role of not only already experienced but anticipated injustices; 2) connecting injustices to transition dynamics in order to exemplify issues associated with different energy futures. For this purpose we created a new multi-scalar (regional, national, international) and multi-horizon (now, now to later, later) mapping tool for energy injustices. Applying the framework to Estonian energy transition, we revealed an inventory of 214 distinct incidents of injustice across 21 different dimensions and 5 clusters, showing the dominance of national/regional and short-term anticipated injustices in media coverage. Connecting the observed incidents to transition dynamics we further showed that policymakers need to navigate between "triple injustices": ones resulting from maintaining the *status quo* (i.e. regime optimization), ones related to getting rid of the *status quo* (regime destabilization), and ones associated with introducing new technologies to challenge the *status quo* (niche acceleration). Here we would like to highlight four novel research directions at the intersection of energy justice and sustainability transitions literature, opened up by our adoption of a multi-horizon perspective and thinking of injustices in transitions language.

First, the injustices do not exist in a vacuum; many are deployed, often strategically, by certain actors at certain times. Energy justice (and claims about it) can therefore be interpreted as a power struggle who gets to set the direction of the current energy transition and reap the future benefits. The implications for ethics is that each narrative downplays certain injustices. Recognition issues are only infrequently recognized as an issue in our sample. Procedure is mostly about entrepreneurship (unfair competition) and much less about the involvement of locals. The tendency for anticipated injustices and distributive injustices to dominate the discourse further illustrates how future injustices are used to shape present decisions, e.g. oil shale proponents favouring the narrative of regional collapse but the opponents stressing environmental and health damage of oil shale production instead. However, if the advocated energy future is to realize the injustices highlighted in alternative narratives need to be properly addressed. In this way, our energy justice mapping points the way towards clear policy

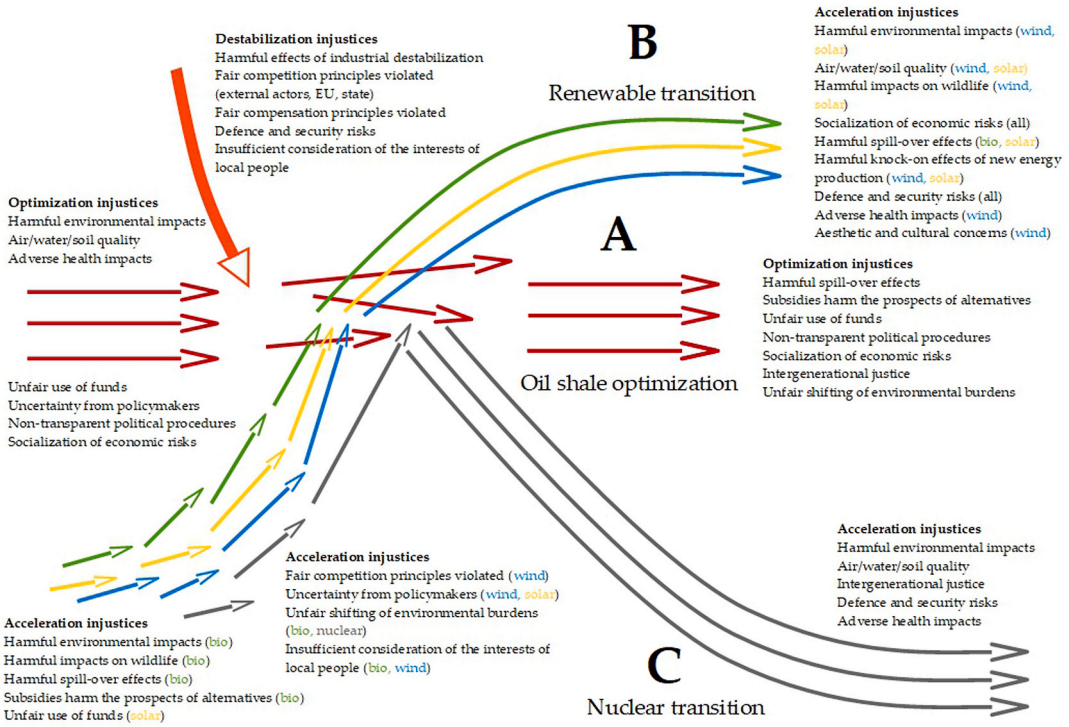

Fig. 2. Energy injustices and transition dynamics in Estonia.
Source: Authors.

remedies, e.g. advocates of renewables need to address the introduction of new injustices elsewhere or the looming decline of Ida-Virumaa, whereas oil shale proponents need to ensure that environmental, waste and health problems would not constitute perpetual problems.

Second, our analysis reveals both the problems of 'packaged injustices' involved with undertaking a transition, but also the injustices with *not* undertaking it. For instance, in the debate on energy futures the citizens of Ida-Virumaa are effectively asked to choose between the combination of higher incomes, severe environmental degradation and adverse health impacts on one hand, and the threat of losing one's job and entering a regional decline on the other hand. However, is it really ethical to ask people to accept well-known and experienced burdens of regime optimization by making an appeal to the allegedly worse yet currently unrealized risks associated with regime destabilization and niche acceleration? Such a dilemma does not fit easily into the existing and widely used categories of justice as recognition, procedure or distribution. It seems to be simultaneously a question of distribution in that not all distributional burdens are being considered, a question of recognition in that those who will face future burdens are not being recognized by current decision-makers, and a question of procedure, because the choice architecture is not sufficient to tackle such concerns.[1] We therefore call more attention to exploring the ethics of forced choice, i.e. instances when issues are framed as zero-sum games with no real attention being given to the possibility of positive-sum outcomes.

Third, interactions between present and anticipated injustices may result in what we would call the "Tenet effect".[2] It refers to a situation in which a probable direction of transition, despite of its manifest benefits in relation to alternatives, might nevertheless end up being crushed between the extended present and anticipated future choices. In the Estonian case, oil shale benefits from the present and nuclear benefits from the future could override renewables. This is paradoxical because renewables have demonstrably lower current environmental impacts than oil shale, whereas they can also be installed much quicker than a nuclear power plant. The realization of this scenario discursively requires downplaying oil shale/nuclear related injustices and overplaying renewable-related ones. The success of this strategy, in turn, depends on the power of different actor coalitions to frame media narratives and shape public opinion. This highlights the need for more work on relations between uneven access to media, representation of energy injustices and their impact on ongoing transitions.

Fourth, it may be that the clash of different types of injustices identified in our study is characteristic to a particular transition phase only. Although further longitudinal research is needed to fully substantiate our claim, we can speculate that in the start-up phase when the focal regime starts to become destabilized but the niches have yet to mature, injustices related to regime optimization would be most prevalent. In the acceleration phase one would expect niche-niche and niche-regime conflicts to be manifested in the presence of various discourses on regime optimization, regime destabilization and niche acceleration injustices. One could further assume that in the stabilization phase the former two would eventually disappear and enthusiasm about the new regime would, at least for a while, be characterized by fairly minor concerns about its downsides. In brief, we suggest the following connections between injustices and transitions dynamics: 1) start-up: low but gradually increasing debate on injustices with regime optimization concerns being dominant; 2) acceleration: high level of debate, clashes between all three types; 3) stabilization: very low level of debate, mainly on injustices associated with the new regime. Future empirical work can show whether this hypothesis stands up to closer scrutiny.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

[1] The authors thank Kirsten Jenkins for making this point.

[2] This term is loosely inspired by the 'temporal pincer' manoeuvre from the movie, where one troop moves forward in time from the present to the future and one backward in time from the future to the present to outflank the enemy.

Acknowledgements

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 884539 "Carbon Intensive Regions in Transition – Unravelling the Challenges of Structural Change (CINTRAN)". The content of this deliverable does not reflect the official opinion of the European Union. Responsibility for the information and views expressed herein lies entirely with the author(s). The authors thank Jessica Jewell, Lukas Hermwille, Kirsten Jenkins (if you read this, one of the authors is still waiting for a response to the last e-mail!), colleagues at the IST2021 conference and three anonymous reviewers for helpful comments on earlier versions of this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.polgeo.2021.102544.

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